

AD-A157 228 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/1
SUNSET LAKE DAM (VT 0. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 79

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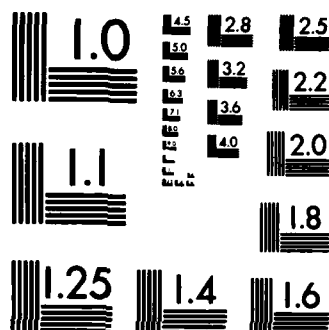
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AD-A157 228

CONNECTICUT RIVER BASIN
BROOKFIELD, VERMONT

SUNSET LAKE DAM
VT.-00241

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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JUL 1 7 1985
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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JUNE 1979

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is an earth fill dam with dry stone masonry walls set on ledge rock. The dam is about 100 ft. long with a maximum height of 12 ft. It is small in size with a significant hazard potential. The dam was judged to be in poor condition. The spillway channels are in poor condition with extensive concrete deterioration. There are a few recommendations which should be implemented by the owner.		



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

NOV 1 1979

Honorable Richard A. Snelling
Governor of the State of Vermont
State Capitol
Montpelier, Vermont 05602

Dear Governor Snelling:

Inclosed is a copy of the Sunset Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Water Resources, the cooperating agency for the State of Vermont. In addition, a copy of the report has also been furnished the owner, Green Trails Resorts Inc., Brookfield, Vermont 05036.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Water Resources for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

SUNSET LAKE DAM

VT 00241

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BROOKFIELD, VERMONT



PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No: VT 00241
Name of Dam: Sunset Lake Dam
Town: Brookfield
County and State: Orange County, Vermont
Stream: Sunset Brook
Date of Inspection: April 24, 1979

BRIEF ASSESSMENT

The Sunset Lake Dam is an earth fill dam with dry stone masonry walls set on ledge rock. The upstream wall has been covered with wood planking to prevent erosion due to wave action and retard leakage. The dam is approximately 100 feet long, has a maximum height of 12 feet, and has two 7-foot wide spillway outlets. The dam is presently retaining a 262 acre-foot impoundment which is used for recreational purposes. Sunset Lake is also the location of the Floating Bridge which is an Historic Landmark.

The dam is classified as small with a significant hazard potential in the event of a dam failure. Based on these classifications, and in accordance with USCE guidelines the 100-year flood was used as the test flood. The test flood inflow from a 4-square mile drainage area was calculated at 1246 CFS and the routed test flood outflow is 1010 CFS which overtops the dam by 1.50 feet. The spillway capacity of 125 CFS is only 12 percent of the test flood.

The dam was judged to be in poor condition. The following significant findings were determined during the investigation:

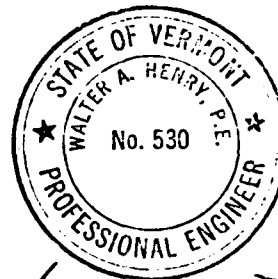
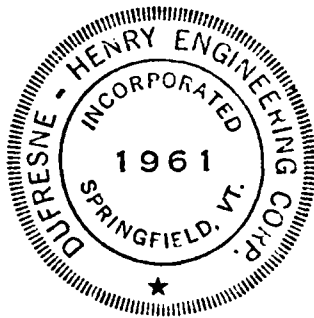
1. The existing spillway openings are severely limited and subject to blockage due to floating debris and an active beaver colony.
2. The spillway channels are in poor condition with extensive concrete deterioration.
3. Trees are growing near the downstream wall.

The following recommendations should be instituted under the guidance of a qualified engineer within one year of the receipt of this report:

1. Design and construct increased spillway capacity.
2. Install a log boom or other appropriate schemes to prevent blockage of the spillway entrance.

3. Install a low-level outlet (drain).
4. Remove trees growing near the downstream face.
5. Institute a formal warning system.
6. Institute a maintenance program, including periodic removal of floating debris as required and an annual technical inspection.

Consideration should be given to lowering the lake level until repairs and/or reconstruction is completed.



Walter A. Henry

This Phase I Inspection Report on Sunset Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph W. Finegan
 JOSEPH W. FINEGAN, JR., MEMBER
 Water Control Branch
 Engineering Division

Carney M. Terzian
 CARNEY M. TERZIAN, MEMBER
 Design Branch
 Engineering Division

Joseph A. McElroy
 JOSEPH A. MCELROY, CHAIRMAN
 Chief, NED Materials Testing Lab.
 Foundations & Materials Branch
 Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar
 JOE B. FRYAR
 Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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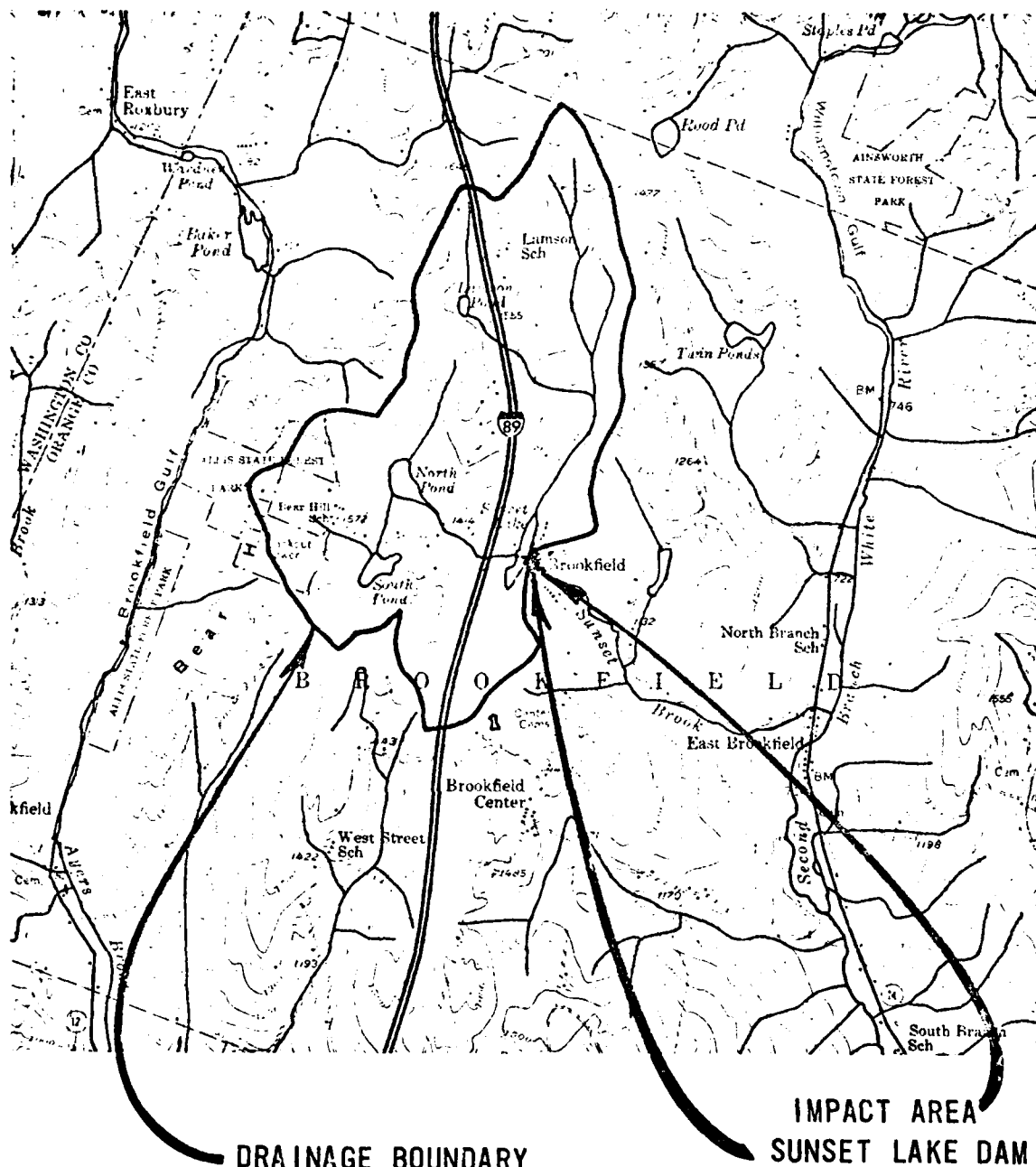
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OVERVIEW OF
SUNSET LAKE DAM
BROOKFIELD, VERMONT



SOURCE OF MAP:
U.S. GEOLOGICAL SURVEY
BARRE QUADRANGLE
VERMONT
15 MIN. SERIES
1957

DUFRESNE-HENRY ENGINEERING CORP.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION MAP
SUNSET LAKE DAM

CLIENT NO 04-0099
ENGR JAD

SCALE 1"=1 MILE
DATE

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: SUNSET LAKE

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0010 has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by nonfederal interests.
- (2) Encourage and prepare the states to initiate quickly effective dam safety programs for nonfederal dams.
- (3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

The dam at the outlet of Sunset Lake is located just south of the floating bridge across the lake and just west of an old mill structure which has been converted into a restaurant known as the Fork Shop (see arrow on overhead photo).

The dam itself is located at 44°2.4' north latitude and 72°33.1' west longitude which is approximately 2.2 miles upstream from the junction of the Sunset Brook and the Second Branch of the White River, which is a tributary of the White River, which in turn is a tributary to the Connecticut River.

b. Description of Dam and Appurtenances

The dam is approximately 100 feet long, 12 feet high and 20 feet wide. It is a dry stone masonry structure with earth fill set on a ledgerrock foundation. The upstream masonry wall is faced with timber planks to reduce erosion due to wave action and retard leakage through the dam.

The spillway structure consists of two spillway outlets constructed of permanent stop logs. The smaller of the two outlets is 4 feet deep by 7 feet wide and formerly carried water via a wooden sluiceway to the water wheel of the old mill (see Photo 5). The hydraulic opening of this outlet is only 7 feet by 1 foot. The spillway channel walls and floor are built of dry masonry which is in fair condition. The two spillway outlets are separated by a 5-foot section of dry masonry.

The second spillway outlet is approximately 7 feet wide by 12 feet deep and has been concrete lined. The concrete lining does not have a solid bearing foundation and is experiencing considerable erosion and cracking in the lower sections. There was no evidence of any reinforcing in the concrete lining (see Photos 6 and 7). The spillway channel contains a large amount of debris originating from local beaver activity. The present hydraulic opening is approximately 7 feet wide by 1 foot 2 inches deep.

The bridges spanning both spillway outlets are constructed of a variety of materials including wooden timbers, steel rails, concrete, dry stone masonry and wood planking. The wood railing along the downstream face is in need of repair.

c. Size Classification

The Sunset Lake Dam is 12 feet high and has a maximum storage of 350 acre-feet. United States Corps of Engineers' Guidelines place dams with a height less than 25 feet and storage between 50 and 1000 acre-feet in the small category. Therefore the size classification of the Sunset Lake Dam is small.

d. Hazard Classification

A failure of the Sunset Lake Dam would route a flood wave into the lower channel. The flood wave would probably cause structural damage and possibly total collapse of the Fork Shop Restaurant and would also impact three homes located approximately 800 feet downstream where the brook crosses under the main road. Since a failure of this dam could cause considerable economic damage and the possible loss of several lives, the dam is classified as being a significant hazard.

e. Ownership

The present owner of the Sunset Lake Dam is:

Green Trails Resorts Inc.
Chris Williams, President
Brookfield, Vermont 05036

Telephone: 802-276-2012

f. Operator

The responsibility for operating the dam lies with the owner.

g. Purpose

The Sunset Lake Dam was originally constructed to supply water to a mill located downstream of the dam. At present, the dam is being used to provide recreational facilities associated with Sunset Lake such as fishing, swimming and boating.

h. Design and Construction History

There is no information on file concerning the original design or construction of the dam. The first known State inspection of the dam occurred on February 15, 1951. That inspection noted a lack of maintenance, decaying upstream wood facing and restricted discharge capacity. Subsequent reports in 1958 and 1970 noted the same general problems of deteriorating upstream planking and inadequate spillway capacity. The upstream planking was found to be in good condition on April 24, 1979 and has obviously been replaced since the last inspection report in 1970, but other recommended work has not been done.

i. Normal Operating Procedures

There are no established operation and maintenance procedures in effect for this dam. Maintenance is performed on an as-needed basis and usually consists of stop-gap, short-term measures. Current maintenance includes clearing the spillway openings of debris from beaver activity. The stop logs are considered permanent and would require heavy equipment to remove.

1.3 Pertinent Data

a. Drainage Area

Sunset Lake has a drainage area of approximately 4 square miles of rolling, wooded terrain. Elevations in the oval-shaped area vary from 1270 at the lake to 2000 in the Allis State Forest Park.

The lake is fed by two separate tributaries, one from the north and the other from the west. In addition to Sunset Lake, there are three other lakes within the watershed, all between 20-25 acres in size.

Interstate Route 89 runs the full length of the watershed in a north-south direction (see Location Map).

b. Discharge at Dam Site

(1) Outlet Works

The only observed outlets at the dam site are the two spillway openings. The present hydraulic openings are 7 feet x 1 foot and 7 feet by 1 foot 2 inches respectively.

There is some indication in the file data that pipes were located in the dam which may have supplied water to some of the downstream buildings. None of these pipes were found during the inspection.

(2) Maximum Known Flood at Dam Site

There are no records of maximum flood flows at the Sunset Lake Dam. Several comments were found in the file data that sand bags and other stop-gap measures have been used in the past to prevent overtopping.

(3) Spillway Capacity

At the present time the two spillway openings are 7 feet by 1 foot and 7 feet by 1 foot 2 inches. The spillways will function as broad crested weirs until the openings become submerged after which orifice flow will control. The maximum combined capacity of the spillways under weir flow is 88 CFS. This will increase to 125 CFS under maximum orifice flow with the water level at the low point of the top of the dam. The stop logs are considered permanent and could not be removed without heavy equipment.

c. Elevations

The following elevations are based on an assumed elevation of 100.0 as the existing spillway crest elevation:

	<u>Feet</u>
(1) Streambed at Centerline of Dam	91.5
(2) Maximum Tailwater	Not known
(3) Upstream Portal Invert Diversion Tunnel	Not applicable
(4) Recreation Pool	100.0

	<u>Feet</u>
(5) Full Flood Control Pool	Not applicable
(6) Spillway Crest (Approximate Sill Elevation)	100.0
(7) Design Surcharge	Not applicable
(8) Top of Dam	103.5
(9) Test Flood Design Surcharge	105.0
d. <u>Reservoir</u>	<u>Feet*</u>
(1) Length of Maximum Pool	2600
(2) Length of Recreation Pool	2200
(3) Length of Flood Control Pool	Not applicable
e. <u>Storage</u>	<u>Acre-Feet*</u>
(1) Recreation Pool	262
(2) Flood Control Pool	Not applicable
(3) Test Flood Pool	402
(4) Spillway Crest Pool	262
(5) Top of Dam	350
f. <u>Reservoir Surface</u>	<u>Acres*</u>
(1) Top Dam	25
(2) Test Flood Pool	28
(3) Flood Control Pool	Not applicable
(4) Recreation Pool	21
(5) Spillway Crest	21
g. <u>Dam</u>	
(1) <u>Type</u>	

Gravity, earth fill, dry stone masonry on ledge rock.

*Estimated based on USGS topographic maps and visual observations.

- (2) Length
100 feet (approximate).
- (3) Height
12 feet.
- (4) Top Width
20 feet.
- (5) Side Slopes
Vertical, dry stone masonry.
- (6) Zoning
Not known.
- (7) Impervious Core
None known.
- (8) Cut-Off
None (ledge rock).
- (9) Grout Curtain
Not applicable.

h. Diversion and Regulating Tunnel

Not applicable.

i. Spillways

- (1) Type
Stop log (2) (permanent).
- (2) Length of Weirs
Seven feet each.
- (3) Crest Elevation
100.0 (assumed).
- (4) Gates
None.

(5) Upstream Channel

Sunset Lake.

(6) Downstream Channel

Sunset Brook.

j. Regulating Outlets

There are no outlets for Sunset Lake other than the two spillways.

SECTION 2 - ENGINEERING DATA

2.1 Design

There is no design data available for this dam.

2.2 Construction

According to record data and as reported by a local senior citizen the Sunset Lake Dam was built to increase the size and depth of an existing pond. The dam was located across the outlet to the original pond in a narrow ravine. The dam was constructed as two dry stone retaining walls, on ledge rock, filled in with earth of unknown consistency.

At some time after the original construction, the upstream wall was covered with a timber facing and the larger of the two spillways was lined with concrete.

The access bridges across the two spillways are constructed of a variety of materials. The left spillway bridge is constructed of steel rails and large flat stones. The top material could not be observed due to the existing gravel patio cover. The larger spillway bridge also includes steel rails as the main structural members. These steel members are then topped with timber planking.

The spillways' sills are constructed of stop logs which are considered permanent because of their location and timber facing which would make them very difficult to remove.

2.3 Operation

The water level in the lake is controlled by the two spillways. To our knowledge the level is not changed according to seasonal changes in runoff. This may be due to the Floating Bridge which might be adversely affected by water level changes.

2.4 Evaluation

a. Availability

Design and construction drawings for this dam are not available. The dimensions and materials indicated on the drawings included in Appendix B have been obtained from previous inspection reports and measurements taken during the April 24, 1979 inspection.

b. Adequacy

The lack of in-depth engineering data does not allow for a definitive analysis of this dam. Therefore, the adequacy of

the dam must be based on visual inspection, past performance history and sound hydrologic and hydraulic engineering judgment.

c. Validity

Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The on-site inspection of the Sunset Lake Dam was performed on April 24, 1979. Weather conditions were clear and cool and ideal for visual observations. No emergency conditions were observed on the day of inspection.

b. Dam

The dam is a dry stone masonry dam with earth fill set on ledge rock. The upstream face has been covered by wood planking to reduce wave damage and limit seepage through the stone facing. The upstream side of the planking has been backfilled with a well-graded fill material.

A portion of the top of the dam is being used by the Fork Shop Restaurant as a patio (see Photo 1). Formerly the top of the dam was an access road to the old school house which is now a private residence (see Photo 1).

The low point of the top of the dam is located on the far left hand side, adjacent to the road (see Photo 1). Surface erosion is evident at this location, indicating that minor overtopping has occurred in the past. At the time of inspection the free-board between the water surface and the low point of the dam was approximately 2 feet.

There are several trees growing near the downstream dam face. Although the trees are not actually in the dam, their root systems most likely extend into the dam embankment and may be a problem should they uproot during a wind storm.

There is some leakage through the dam on the left, downstream face, beneath the Fork Shop Restaurant patio (see Photo 2). The leakage was clear and did not appear to contain any soil particles.

c. Appurtenant Structures

The spillway structure consists of two spillway outlets controlled by stoplogs. The smaller of the two outlets is four feet deep by seven feet wide and formerly carried water via a wooden sluiceway to the water wheel of the old mill (see Photo 5). With the stop logs in their present position and the upstream planking the hydraulic opening of this outlet is only 7 feet by 1 foot. The spillway channel walls and floor are built of dry masonry which is in fair condition. The two spillway outlets are separated by a 5-foot section of dry masonry.

the dam must be based on visual inspection, past performance history and sound hydrologic and hydraulic engineering judgment.

c. Validity

Not applicable.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The on-site inspection of the Sunset Lake Dam was performed on April 24, 1979. Weather conditions were clear and cool and ideal for visual observations. No emergency conditions were observed on the day of inspection.

b. Dam

The dam is a dry stone masonry dam with earth fill set on ledge rock. The upstream face has been covered by wood planking to reduce wave damage and limit seepage through the stone facing. The upstream side of the planking has been backfilled with a well-graded fill material.

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The spillway structure consists of two spillway outlets controlled by stoplogs. The smaller of the two outlets is four feet deep by seven feet wide and formerly carried water via a wooden sluiceway to the water wheel of the old mill (see Photo 5). With the stop logs in their present position and the upstream planking the hydraulic opening of this outlet is only 7 feet by 1 foot. The spillway channel walls and floor are built of dry masonry which is in fair condition. The two spillway outlets are separated by a 5-foot section of dry masonry.

The second spillway outlet is approximately 7 feet wide by 12 feet deep and has been concrete lined. The concrete lining does not have a solid bearing foundation and is experiencing considerable erosion and cracking in the lower sections. There was no evidence of any reinforcing in the concrete lining (see Photos 6 and 7). The spillway channel contains a large amount of debris originating from local beaver activity. The present hydraulic opening is approximately 7 feet wide by 1 foot 2 inches deep.

The bridges spanning both spillway outlets are constructed of a variety of materials including wooden timbers, steel rails, concrete, dry stone masonry and wood planking. The wood railing along the downstream face is in need of repair.

The stop logs were inaccessible during the inspection and could not be measured. Removal of the stop logs would require removal of a portion of the timber planking and would most likely require heavy equipment. For these reasons the stop logs are considered permanent and nonadjustable.

d. Reservoir Area

The reservoir area is known as Sunset Lake and includes an historic landmark called "The Floating Bridge" which spans the lake adjacent to the dam. It is assumed that the water level of Sunset Lake is a significant factor in the stability of the Floating Bridge.

In recent years, a beaver colony has established itself in Sunset Lake. These animals have attempted to construct a beaver dam at the spillway opening requiring periodic removal of debris. This debris can be seen on top of the dam in Photos 1, 4 and 6. In an attempt to keep the beaver out of the spillway openings, the owner has placed a wire mesh fence in front of the openings. This has proven ineffective since the beaver are now building their dam in the wire fence. The fence is also collecting a considerable amount of floating debris and has resulted in a reservoir level surcharge of approximately one foot above the spillway crest.

The reservoir, immediately upstream, is very shallow due to sedimentation and material which has been placed against the upstream face to reduce leakage. The water depth is one to two feet deep across the upstream width of the dam.

It has been reported that a natural pond existed at the site prior to the dam construction. The dam was placed across the natural pond outlet, increasing the pond size and depth to provide mechanical hydropower for the mill located downstream

of the dam. Ledge rock can be seen in three to five feet of water upstream of the dam. The size and elevations of the reported original pond could not be determined without dewatering the dam.

e. Downstream Channel

The Fork Shop Restaurant (former mill) is located immediately downstream of the dam and adjacent to the downstream channel. Some of the structural foundation supports of this building are located in the channel streambed (see Photo 9). A few of these supports are of questionable structural integrity.

A stone wall partially crosses the downstream channel, approximately 30 feet from the downstream face of the dam (see Photo 5). From the location and configuration, it is assumed that this wall supported the original water wheel for the mill. Further downstream, a wood pedestrian foot bridge spans the channel. The stream runs adjacent to the main road for approximately 800 feet before crossing the road through a stone masonry culvert with an upstream opening. There are several homes at this location which might be impacted by a flood wave should the dam fail (see Photo 10).

3.2 Evaluation

The visual inspection indicated that the dam is in overall poor condition. The following observations indicate potential problems:

- (1) The hydraulic openings of the spillway outlets are small and subject to blockage due to beaver activity and floating debris.
- (2) Inadequate freeboard.
- (3) The concrete lining in the larger spillway is deteriorating. A failure of this lining may cause extensive damage to the dry masonry behind it.

The second spillway outlet is approximately 7 feet wide by 12 feet deep and has been concrete lined. The concrete lining does not have a solid bearing foundation and is experiencing considerable erosion and cracking in the lower sections. There was no evidence of any reinforcing in the concrete lining (see Photos 6 and 7). The spillway channel contains a large amount of debris originating from local beaver activity. The present hydraulic opening is approximately 7 feet wide by 1 foot 2 inches deep.

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The reservoir, immediately upstream, is very shallow due to sedimentation and material which has been placed against the upstream face to reduce leakage. The water depth is one to two feet deep across the upstream width of the dam.

It has been reported that a natural pond existed at the site prior to the dam construction. The dam was placed across the natural pond outlet, increasing the pond size and depth to provide mechanical hydropower for the mill located downstream

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SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

None.

4.2 Maintenance of Dam

Maintenance of the dam is performed on an as-needed basis and generally consists of clearing debris from the spillway outlet openings.

4.3 Maintenance of Operating Facilities

None.

4.4 Description of Warning System in Effect

None exists for this dam.

4.5 Evaluation

The removal of debris from beaver activity requires a more permanent solution, including removal of the beaver colony and regular periodic removal of floating debris. Failure to remove the debris may cause a serious hydraulic problem and possible overtopping of the dam during storm conditions. At the time of inspection, the accumulated debris had resulted in a lake surcharge of approximately one foot above the spillway crest.

SECTION 5 - HYDRAULIC AND HYDROLOGIC EVALUATION

5.1 Evaluation of Features

a. General

The Sunset Lake Dam is an earth fill masonry dam with vertical wooden planking for an upstream face. The lake is used solely for recreation and is located adjacent to the Floating Bridge in Brookfield, Vermont.

b. Design Data

There is no existing design data available for this dam. The hydraulic and hydrologic evaluation is based on field measurements and file data.

c. Experience Data

There are no records available for Sunset Lake Dam. However, correspondence on file with the Vermont Department of Water Resources refers to events during Hurricane Belle which occurred in August 1976. According to a letter from the Selectmen of Brookfield, an attempt was made during the hurricane to stop the overtopping of the dam. The owner of the dam installed additional planking across the face of the dam.

d. Visual Observations

The visual inspection revealed an area of surface erosion at the left abutment of the dam caused by overtopping. The openings of both spillways are being blocked by accumulated debris. A wire mesh fence has been placed in front of the spillways in an attempt to keep the openings of the spillways from collecting debris. However, due to the intensive beaver activity in front of the fence, this measure proved unsuccessful. The debris is now collected on the fence which continues to hinder the flow through both spillways. Several seeps were found through the dry stone masonry downstream face of the dam.

e. Test Flood Analysis

Based on a size classification of small and a hazard classification of significant, the test flood was selected to be the 100-year frequency flood. The test flood was developed using Soil Conservation Service data for small watersheds and a basis that the 100-year peak rainfall is 5.3 inches. After routing the inflow of 1246 CFS, again using Soil Conservation Service data utilizing the ratio of the drainage area to the total pond area, the routed test flood outflow was determined to be

1010 CFS (250 CSM). During the test flood the Sunset Lake Dam would be overtopped by 1.50 feet of water, providing that the left abutment would not erode first. The combined capacity of both spillways is only 125 CFS which represents 12 percent of the test flood flow.

f. Dam Failure Analysis

In the event the Sunset Lake Dam failed, with the water elevation at the top of the dam, an initial wave of water approximately 8.3 feet would be released. This would be a significant increase in stage over the 1.5 feet flowing in the stream for 125 CFS which is the spillway capacity. The dam failure would produce approximately 2,600 CFS. Immediate damage would occur to the Fork Shop Restaurant which is located just below the dam. The restaurant would be seriously undermined as it currently sits on piers with its underneath exposed to the streambed. It is probable that the restaurant would collapse after the dam broke. As the wave continued downstream it would be completely confined within the channel until it reached a location approximately 800 feet downstream of the dam. At this point the stream makes a 90-degree bend and enters a stone box culvert. Also at this location is a home situated near the stream bank. The wave of water would impact the side of the house, surcharge the box culvert and flow approximately 3 feet deep over the road. Two more houses, one down the road 75 feet more and the other just across the road would be substantially damaged as the water level would be 3 feet high around them.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no visual indications of present instability. However, the visual inspection indicated potential future stability problems due to deterioration of the spillway and the potential for overtopping due to blockage of the entrance to the spillways.

b. Design and Construction Data

There is practically no design and construction data and thus the stability of the dam could not be formally analyzed.

c. Operating Records

There are no operating records available.

d. Post-Construction Changes

There are no known post-construction changes except for repairs consisting of replacement of the upstream wood planking and some concrete work on the right spillway.

e. Seismic Stability

The dam is located in Seismic Zone 2 and in accordance with the recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The dam is judged to be in poor condition on the basis of the visual inspection. The main items of concern are:

1. The deterioration of the spillway walls.
2. The tendency to develop blockage of the entrance of the spillway by debris.
3. The lack of a low-level outlet for emergency lowering of the reservoir.
4. The lack of adequate spillway capacity.
5. Trees are growing near the downstream toe of the dam.

b. Adequacy of Information

The design and construction data available for the dam is practically nil and thus the assessment of the condition of the dam is based solely on the visual inspection.

c. Urgency

The recommendations presented in Sections 7.2 and 7.3 should be carried out within one year of receipt of this report by the owner, with the exception of item 7.2.a which should be done immediately.

d. Need for Additional Investigations

There is no need for additional investigations beyond those recommended in Section 7.2.

7.2 Recommendations

The following repairs and modifications should be performed under the direction of a professional engineer qualified in dam engineering:

- a. Immediately remove the wire mesh fence in front of the spillway and install a log boom or other appropriate schemes to prevent blockage of the spillway entrance.
- b. Design and construct increased spillway capacity.

- c. Installation of a low-level outlet to permit lowering of the reservoir to a safe level in case of an emergency. The level of such an outlet should be determined by an engineer after a survey of the area immediately upstream of the dam.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

1. Institute a program of annual periodic technical inspection.
2. Remove beaver debris on a more frequent basis.
3. Remove trees growing near the downstream dam face.
4. Repair the wood hand railing,
5. Institute a formal warning system.
6. Monitor all seeps regularly for changes in flow and turbidity.

7.4 Alternatives

No practical alternatives.

APPENDIX A

VISUAL INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT SUNSET LAKE DAM

DATE April 24, 1979

TIME 9:15 - 11 AM

WEATHER Clear, 70's

W.S. ELEV. _____ U.S. _____ DN.S. _____

PARTY:

1. <u>Walter A. Henry</u>	<u>D-H</u>	6. _____
2. <u>James A. Dohrman</u>	<u>D-H</u>	7. _____
3. <u>Wayne A. Leonard</u>	<u>D-H</u>	8. _____
4. <u>Gonzalo Castro</u>	<u>GEI</u>	9. _____
5. _____		10. _____

PROJECT FEATURE	INSPECTED BY	REMARKS
1. _____		
2. _____		
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

PROJECT FEATURES

DISCIPLINE

DATE APR 24 1970

PAGE

PAGE

SECTION

Blanking out wood

None observed

Sealed pattern ground

None observed

None observed

Too irregular to judge

Too irregular to judge

Faint, some leakage next to grillways

Not applicable

Not applicable

None observed

None observed

None observed

Some seepage on left side under pattern

None observed

None observed

None observed

PERIODIC INSPECTION CHECK LIST

PROJECT SUNSET LAKE DAM DATE April 24, 1979
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	
Slope Conditions	Not applicable.
Bottom Conditions	Excessive siltation.
Rock Slides or Falls	None observed.
Log Boom	None.
Debris	Extensive - beaver activity.
Condition of Concrete Lining	Not applicable.
Drains or Weep Holes	Not applicable.
b. Intake Structure	Not applicable.
Condition of Concrete	Not applicable.
Stop Logs and Slots	Not applicable.

PERIODIC INSPECTION CHECK LIST

PROJECT SUNSET LAKE DAM DATE April 24, 1979
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	NONE
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Control Tower	

PERIODIC INSPECTION CHECK LIST

PROJECT SUNSET LAKE DAM

DATE April 24, 1979

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	NONE
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT SUNSET LAKE DAM

DATE April 24, 1979

PROJECT FEATURE

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

PERIODIC INSPECTION CHECK LIST

PROJECT SUNSET LAKE DAM DATE April 24, 1979
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	Poor - beaver debris is restricting the spillways.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None
Floor of Approach Channel	None.
b. Weir and Training Walls	
General Condition of Concrete	Stop log spillways (2); 1 - 6 x 4; 1 7 x 12.
Rust or Staining	Poor, undermining at downstream end.
Spalling	None observed.
Any Visible Reinforcing	Minor.
Any Seepage or Efflorescence	None.
Drain Holes	Could not be directly observed - too much flow over spillway.
c. Discharge Channel	None observed.
General Condition	Poor.
Loose Rock Overhanging Channel	Yes.
Trees Overhanging Channel	Yes.
Floor of Channel	Natural stone rubble.
Other Obstructions	Beaver debris.

PERIODIC INSPECTION CHECK LIST

PROJECT SUNSET LAKE DAM DATE April 24, 1979
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - BRIDGES OVER SPILLWAYS</u>	
a. Super Structure	Railroad rails with wood planking and stone slabs.
Bearings	Stone training walls.
Anchor Bolts	None observed.
Bridge Seat	Stone training walls.
Longitudinal Members	Railroad rails, timbers.
Under Side of Deck	Timber/natural stone.
Secondary Bracing	None observed.
Deck	Timber/concrete/stone.
Drainage System	None known.
Railings	Wood - poor condition.
Expansion Joints	None.
Paint	None.
b. Abutment and Piers	Stone training walls.
General Condition of Concrete	Not applicable.
Alignment of Abutment	Fair.
Approach to Bridge	Good.
Condition of Seat and Backwall	Not applicable.

PERIODIC INSPECTION CHECK LIST

PROJECT SUNSET LAKE DAM DATE April 24, 1979
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>RESERVOIR AREA</u>	
Stability of Shoreline	Good.
Sedimentation	Extensive 1-2 feet from surface.
Changes in Watershed Runoff Potential	Route I-89 construction, beaver in upper ponds.
Upstream Hazards	Possible damage to Floating Bridge - Historical Site, beavers.
Downstream Hazards	Several (3) homes plus restaurant.
Alert Facilities	None known.
Hydrometeorological Gages	None.
Operational & Maintenance Regulations	None known.

APPENDIX B

PROJECT RECORDS AND PLANS

A. List of Design Construction and Maintenance Records:

None.

B. Copies of Past Inspection Reports:

1. Inspection by Vermont Public Service Commission,
February 15, 1951.
2. Inspection by Department of Water Resources,
October 17, 1958.
3. Inspection Report by Dubois & King for the Department
of Water Resources, June 1970.

4-6. Miscellaneous Correspondence.

C. List of Plans:

Sunset Lake Dam
Plan - Typical Section

BENNINGTON

WALTER B. RENFREW

NEWBURY

FRANCIS W. LEACH

RUPERT



STATE OF VERMONT
WATER CONSERVATION BOARD
MONTPELIER

REPORT ON TWO DAMS IN BROOKFIELD, VERMONT

The writer visited two dams last summer in the town of Brookfield, Vermont. One is the Sunset Lake dam, which, previously, has been notoriously appraised and subsequently investigated by Water Conservation Board engineers. The other is the Patterson and Holden dam. The writer's findings on both these structures are reported herein.

✓ Sunset Lake Dam

Introduction - Sunset Lake, sometimes called Colt's Pond, was once maintained as a mill pond. This use discontinued, it now serves recreational purposes. It is located in the headwaters of Sunset Brook, affecting a drainage area of 4 square miles. The water rights are presently owned by Miss Jessie C. Fiske, a summer resident of the town.

At maximum level, the lake has a surface area of about 100 acres and a useable volume of about 17,000,000 cubic feet.

Layout of the dam - The dam at the outlet is a dry stone masonry structure on a ledge rock foundation. It is rectangular in cross-section, being about 100 feet long, 20 feet wide and 12 feet high. Its ends extend well into the overburden. For a flow retarding element it has an upstream timber facing backed by an earth fill.

Two rectangular, open channel outlets are provided. One is 12 feet deep and 7 feet wide (concrete-lined) and the other is 4 feet deep and 6 feet wide.

It is located in the middle of the dam but separated by a short length of the full masonry section. Stop-logs are used to control the flow.

The top of the dam serves as a roadway.

Comments on Inspection - To comment on the condition of the dam is to recount the observations indicated by previous investigators. The dam shows a lack of maintenance. Only the stone masonry has weathered well. The upstream timber facing has decayed so that much leakage occurs through the joints of the masonry section. (Some control of leakage is afforded by the silt blanket at the upstream toe). The stop-logs are in a shabby condition and probably difficult to remove if required.

The section is ample for stability, but excessive leakage may have an indirect effect on its soundness. This is more probable under extreme pond conditions.

Discharge conditions indicated crowding of the freeboard and possible overtopping. Relying on the human element in removing stop-logs during flood flows makes the latter that much more ^apr_jsumable.

A normal pond level about 2 feet below the top of the dam appears to be desirable for the floating bridge crossing the pond.

Recommendations - Noting that discharge capacity at this dam should be more or less automatic, the writer recommends transforming the existing outlets into a full length spillway (18 feet) with its crest about 5 feet below the top of the dam. Fin-type flashboards could maintain the present pond level. An earth fill against the upstream face of the dam can be used to secure the leakage through the structure.

Patterson and Holden Dam

Introduction - This dam was built in 1932 for private electric power generation. The power phase of the development has now been abandoned and

the pond is maintained for recreational purposes. The Patterson and Holden Company owns the dam, with H. H. Holden the surviving partner.

The dam is located on a small tributary to Sunset Brook. It impounds about 1,300,000 cubic feet of water with a pond surface area of about 6 acres. The drainage area is 0.75 square miles.

Type of dam and dimensions - The dam is of earth, supposedly with a clay core. It is about 250 feet long, 16 feet deep at maximum section and 15 feet wide at the top. The upstream face is at the natural slope of the material while the downstream face is retained by a vertical dry stone masonry wall showing a top thickness of 2 feet.

At the east end of the dam is a drop-inlet type of outflow. A concrete inlet 6 feet high and 2 feet wide is equipped with stop-planks to the desired level. After dropping into this riser, the flow is conducted past the dam by means of ^a 2 foot conduit. An abandoned intake structure for the water wheel used at one time is located in the center of the dam.

Comments on Inspection - The earth embankment appears stable enough. Some wetness at the west abutment indicated possible seepage but not of a serious nature. The abandoned intake leaks a little.

According to the owner, the outlet structure has failed twice due to a washout of surrounding material. Noting its location and construction, such a failure is possible again. Discharge capacity is limited for a probable flash flood.

Although it needs better provision for discharge, the dam is in good enough general condition for its size and location.

Stephen H. Haybrook

Stephen H. Haybrook
Hydraulic Engineer
Public Service Commission

February 15, 1951

MEMORANDUM

DATE: October 17, 1958

SUBJECT: Sunset Lake Dam - Brookfield, Vermont

On this date the writer inspected the Sunset Lake Dam. It was reported by Jim MacMartin of the Fish & Game Service that at one time during the summer, sandbags were used to protect the dam as there appeared to be some anxiety as to the safety of the dam.

No evidence was observed on this date of sandbags in place, however, a considerable amount of clay had been placed adjacent to the upstream face of the dam apparently during the past summer.

The dam is a masonry faced structure backfilled with earth and having a plank retaining wall on the upstream side for protection against wave action. The overall height of the dam is about 17 feet; it is 25 feet thick and about 100 feet in length. The land for about 150 to 200 feet north of the dam (which includes a main town highway) is at about the same elevation as the dam. This is the pond with the floating bridge. The dam itself is used as a roadway which is the main access to the village schoolhouse.

There is no emergency spillway. Discharge from the dam passes through two rectangular openings. They are 6.5' and 6.0' wide. As there is about two feet of stoplogs in place, only one foot of water may be passed over the stoplog crest and through the openings.

There is a very small amount of seepage at present but several 1" and 2" water pipes pass through the structure and might be conducive to future seepage.

In past years, some deterioration of the masonry face has occurred. Visual examination does not disclose any substantial deterioration in recent years.

There is a small amount of brush on the dam but no trees.

Maintenance on the dam appears to be fair but is of the stop-gap nature. That is to say, it is performed under the stress of the moment. No preventive type maintenance appears to be followed.

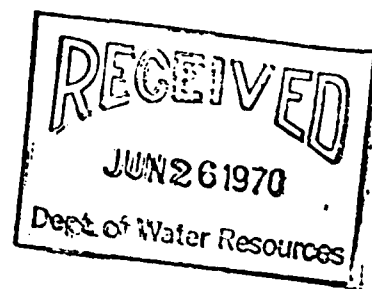
The drainage area is about 4.3 square miles which would produce a maximum run-off into the pond of about 3000 c.f.s. The surface area to Sunset Lake is 21 acres which represents a dam capacity of 17 million cubic feet of water.

In the distant past the water was used to supply mill power, but at present there is no commercial use made of the structure.

ROUTING		
GENERAL		
TO	NOTED	DATE
DWH	DWH	10-20-58
EC	JL	10-20
	\$	1-22-1960
SOFT COPY TO		
FILE		

Donald W. Webster
Civil Engineer

INSPECTION REPORT
ON
SUNSET LAKE DAM
AT
BROOKFIELD, VERMONT



Prepared For
Department of Water Resources
State of Vermont

June, 1970



DuBOIS & KING
Engineers • Planners
RANDOLPH, VERMONT

SUNSET LAKE DAM

Sunset Lake Dam

Vermont has experienced a history of major floods during which loss of life occurred and extensive property damage resulted. Structure failure of existing dams and the inadequacy of their spillways and outlet structures has contributed significantly to resulting peak flood flows and associated flood losses. These failures resulted from inadequate hydraulic capacity to pass flood waters, improper and inadequate structural design and stability of the dams, and inadequate or improper maintenance or repair of existing structures.

The Vermont Water Resources Board is charged with the authority to investigate certain dams under the jurisdiction of the Board, under the authority granted by Title 10, Vermont Statutes Annotated, Section 708 and 714. These investigations are primarily to assure the public that the dams are in a safe state of upkeep and repair and are also adequate to pass flows of water, which may reasonably be expected.

The Department of Water Resources has retained the consulting engineering firm of DuBois & King to make inspections and investigations to evaluate the adequacy of the structures.

Visual examinations of the Sunset Lake Dam were made on October 1, 1969, and June 11, 1970. Topographic surveys of the structure and surrounding area were made on May 26, 1970 and the general features of the structure are indicated on Exhibits 1 and 2 in the back of this report. Photographs were taken on June 11, 1970 and are also in the back of this report.

Purpose

The purpose of this inspection report is to:

1. Summarize the findings as a result of our investigation of the Sunset Lake Dam in the Town of Brookfield, Orange County, Vermont.
2. Report on the present state of the structure, its upkeep and repair.
3. Evaluate the adequacy of the spillways and outlets to pass the flows of water which may be reasonably expected.
4. Recommend to the Board appropriate action to be taken in view of any reasonable flood hazard associated with the existing dam.
5. Recommend to the Board any necessary repairs or alterations.

Scope

The scope of this investigation includes:

- a. Visual field inspections of the structure and surrounding site to ascertain the physical characteristics and conditions of the dam.
- b. Field surveys and measurements to determine dimensions of the structure.
- c. Studies to determine the adequacy of the spillways and outlets to pass flood flows which might be reasonably anticipated.
- d. Summarizing the investigations, surveys, and photographs into this report.

Watershed Description

Up stream of the Sunset Lake Dam the watershed has a drainage area of approximately 3.9 square miles. Within this watershed there are four significant ponds, Lamson Pond having a surface acreage of 23 acres, North Pond having a water surface of 25 acres, South Pond with a water surface of 21 acres, and Sunset Lake which also has a water surface of 21 acres. The three ponds other than Sunset Lake are located in the upper regions of the drainage area.

The watershed itself is roughly oval in shape with the steepest slopes being located on the westerly side in the vicinity of the Allis State Forest Park.

A location plan is shown as Exhibit 3 in the back of this report.

Sunset Lake is fed primarily through two major tributaries. The first being an unnamed brook from the area of the North and South Ponds entering the Lake on the westerly shore, and the second being the drainage from the northerly section of the watershed entering the northern end of the Lake.

Site Description

The dam at the outlet of Sunset Lake is located just south of the floating bridge across the Lake and just west of an old mill structure which has been converted into a restaurant known as the Fork Shop.

The dam itself is located at a point approximately 2.2 miles up stream from the junction of the Sunset Brook and the Second Branch of the White River, which is a tributary of the White River, which in turn is a tributary to the Connecticut River.

At spillway elevation the pond created by the dam is generally long and narrow in the north-south direction. The water surface is generally at an elevation of approximately U. S. G. S. elevation 1272 and has a

surface acreage of about 21 acres. Present use of the Lake is for boating, fishing, swimming, and other recreational purposes.

Immediately down stream of the dam and located along the ravine of the water course are several homes built along the town road.

Structure Description

Four photographs taken on June 11, 1970, are included in the back of this report and show the condition and state of the structure on that date. Plans indicating general details of the structure and the surrounding area are included as Exhibit 1 and Exhibit 2 in the back of this report.

The structure is generally a dry masonry dam with some concrete work at various locations in its construction. Stone retaining type walls have been built across a narrow ravine where the outlet of a natural pond, now known as Sunset Lake, occurred. These retaining walls are shown in Photograph No. 4, and support a roadway across the top of the dam as indicated in Photograph No. 1, with the assistance of concrete abutments.

The up stream face of the dam consists of heavy wooden timbers embedded in the earth fill against the stone retaining walls, as shown in Photograph No. 1. This wood facing apparently has made the structure more watertight than the mixture of earth fill and stone retaining walls and has been placed there for that purpose.

The two spillway sections as they presently exist are shown on Photograph No. 2. Note that severe erosion has occurred, particularly during the past winter, at the outlet of the Lake to the South spillway. This is evidenced by the makeshift planking placed across the outlet opening in an effort to curb further erosion of the Lake bed immediately adjacent to the outlet, and to maintain water level in the Lake.

The wood plank bridge and concrete slab over the spillway sections are utilized by light highway traffic and pedestrians.

The two spillway sections are approximately a 2 feet by 7 feet opening and a 3 feet by 7 feet opening. The northern most spillway passes completely through the top part of the dam and discharges on the down stream stone face. The southern spillway discharges by free fall to the brook bed which is bed-rock directly beneath the wood plank bridge.

There appears to be no means to drain the pond, except perhaps by removal of the southern spillway section, which would only draw the pond down some 6 to 8 feet.

The actual interior construction of the dam beneath the exposed work is not known as only visual observations were made during the inspection of this structure.

Structural Condition

The following observations are based solely on visual examination of the structure, without benefit of detailed plans and design data.

1. The dry stone walls, concrete section, and earth work within the structure appear to be designed with adequate sections but have disintegrated and deteriorated appreciably and are in need of repairs.

2. The heavy wooden timber dam or timber facing on the up stream side of the dam has seriously deteriorated and is in need of repairs.

3. Serious erosion is occurring on the up stream side of the dam at the inlet to the southern spillway.

4. Erosion and deterioration of the concrete abutment has occurred on the down stream side of the south spillway section at the location indicated in Exhibit 2.

5. The wood plank bridge and concrete slab bridge over the spillway section is adequate and is in fair repair. Wood planks need replacing at places, particularly on the down stream side toward the Fork Shop.

6. A hole or gap in the stone and earth fill between the two spillways exists as shown in Photograph No. 3.

7. The traffic bridges while not in the best of repair appear reasonably safe and sound for light vehicle use and pedestrian traffic.

Adequacy of Spillway

On June 11, 1970, at the time of inspection of the structure approximately 6 inches of water was passing towards the eroded outlet section of the southern spillway.

As indicated in Photograph No. 1, the water level in the Lake was down appreciably.

In their present deteriorated condition, as shown on Photograph No. 2, together with the large wooden beams that restricts the outlet of water through the spillways, it is difficult to estimate accurately the discharge capacity of the spillway.

Stop planks placed in front of the spillways are apparently removed during the winter months and in the spring to permit higher discharge capacity to pass through the outlet works.

The discharge capacity of the spillways will vary depending upon whether the stop planks are in position or not. Assuming the stop planks are not in position and the wooden structural parts are in the present state of repair, the discharge capacity is estimated at 50 CFS with one foot of freeboard, and 200 CFS with no freeboard.

With the stop planks in place the discharge capacity of the spillways would be approximately 25 CFS with one foot of freeboard. This discharge capacity would be increased to approximately 70 CFS with no freeboard.

In establishing any reasonable flood that might occur and be expected to pass through the Sunset Lake Dam some consideration should be given to the pondage in the three ponds up stream of Sunset Lake in addition to the pondage on the Lake itself. A detailed study of this pondage and relationship of runoff has not been made but it is estimated that a reasonable unit rate of runoff at the Sunset Lake Dam would be of the magnitude of 500 cubic feet per second per square mile, which would result in an anticipated peak discharge of 1,950 cubic feet per second for the 2.9 square mile drainage area.

Since the estimated capacity of the spillways is at a maximum of 200 CFS with no freeboard under the most open conditions without stop planks, it is concluded that the spillways are highly inadequate to pass a flood flow of 1,950 CFS which may be reasonably expected and would be used for design of a realistic spillway discharge.

Recommendations

Based on visual examination of the structure it is recommended that:

1. An adequate spillway be considered to provide a minimum discharge capacity of 1,950 cubic feet per second without flooding the surrounding area.
2. Emergency repairs be made to the south spillway immediately to prevent further deterioration and erosion to the structures.
3. Replacement of the wooden dam or timber facing be made immediately as a short term alternative to rebuilding the upstream face of the dam with structural concrete.
4. The open joints in the dry stone walls on the downstream side be mortared closed so as to provide an aesthetically pleasing appearance, yet functionally a tight and stable stone facing.
5. Repairs be made to the concrete abutments as necessary in the near future.
6. Replacement of defective wood planks on the top of the structure in the bridges over the spillway be made immediately.

Respectfully submitted,

DUBOIS & KING



Richard E. DuBois, P. E.

SOIL CONSERVATION SERVICE 96 College Street, Burlington, Vermont 05401

DATE: **June 25, 1973**

I spoke with Donald Spies of the Department of Water Resources last week pertaining to the Inspection Report on Sunset Lake Dam at Brookfield, Vt.

1. Replace timber facing on upstream face of dam.

2. Rebuild both wooden spillways so that flash boards are well seated and leak as little as possible. Inlet channels to both spillways should be protected with riprap so that scour does not occur due to high entrance velocities.

3. The surface of the road over the dam should be protected either by paving or with riprap. If the latter option is used, approximately 12 inches of the existing dirt road surface should be removed and replaced with well graded rock fill (max. size 12"). A thin layer of clean, bank run gravel may be placed over the rock to make it smoother for travel if desired.

I am returning Mr. Williams' copy of the inspection report with this Memo. Please contact me if you have any questions.

Richard A. Fisher
Civil Engineer

ROUTING

GENERAL

TO: HJR
DHS
WATrmin

DATE: 6/26

FILE: Sunset L. Day
Brookfield

State of Vermont

ROUTING

GENERAL

TO	NOTED	DATE
AJR	<input checked="" type="checkbox"/>	3/27
DJM	4/1	3/27/74
APB	am	3/28/74
DHS	Q/s	3-28-74

SUBMITTED TO

FILE

AGI



Rural Inn & Fork Shop Restaurant
Fully Licensed - Reservations Requested
Pond Village Country Store

by the Floating Bridge
Brookfield, Vermont 05036

"Hardly Changed in 100 Years"

802 - 276 - 2012

Chris & Sherrill Williams and Ed & Mary Ellen Taylor

Ski Touring

Horseback Riding

MEMORANDUM

To: Andre J. Rouleau

From: Donald J. Manning and A. Peter Barranco

Date: March 20, 1974

Subject: Sunset Lake Dam

Mr. B. Whittaker referred Mr. E. Taylor and Mr. C. Williams (see attached card) to us to discuss subject dam relative to state sharing in funds to make repairs as noted in DuBois & King, Inc. and SCS reports. They say they do not have sufficient funds, and the public do benefit from the lake and dam.

Note the following items:

1. By deed, they believe they own the dam and road.
2. The town maintained the road as long as the school functioned, but this is not the case now.
3. Says town has no legal claim to the road. From advice from their attorney, they were able to close off last year, also the previous year for a portion of the time. Do not wish this to be public; use as parking area for restaurant.
4. Has talked with SCS and advised work with the State. They did not recommend treatment as elaborate as DuBois & King report.
5. Questioned legality of road as part of dam. We mentioned that we could not reply to this as is legal problem.
6. We advised that we do not have any funds in the Department. Also we do not know of any elsewhere, or can think of any exception. Also we think unfavorable to State purchase as do not wish to be public. They may wish to contact Bob Farrington for his advice.
7. They plan to contact highway and historic sites for possibilities of funding assistance.

copy BOR
jst.

TOWN OF BROOKFIELD, VERMONT

OFFICE OF SELECTMEN
BROOKFIELD, VERMONT 05036

August 12, 1976

State of Vermont
Water Resources Dept.
28 School St.
Montpelier, Vt. 05602

RE: Sunset Pond Dam
Brookfield, Vt.

ROUTING		
GENERAL		
TO	NOTED	DATE
20K		8/12
DM	lpm	
DS	Dets	8-20-76
LR	LR	9/13/76
SUSPEND TO		
FILE		

Gentlemen:

Questions have been raised by some of Brookfield's residents concerning the dam which controls the water level in Sunset Pond in our town. The dam is located at the Fork Shop Restaurant owned by Green Trails Inn and Ski-Touring Center. The dam itself is purportedly owned by Green Trails. The questions arose most recently from events connected with Hurricane Belle.

It is reported that as the water level rose in Sunset Pond the owners of Green Trails put additional planks across the dam to hold back the water, evidently in an attempt to stop the washing away of some gravel on the terrace of the Fork Shop. The point of great concern is that raising the water level raises the pressure on the dam, also raising the possibility of the dam giving way completely. There are many homes along the course of the flow below the dam which would be endangered.

Finally we come to the questions: Who has the ultimate responsibility in the control of the water level of such a potentially dangerous body of water? Are the alleged owners of the dam responsible (namely Green Trails)? What, if any, control or responsibility do the Selectmen have under these conditions (or under more normal "everyday" conditions)?

Of interest to the State also is the Floating Bridge on the pond in question. The bridge is part of the State Highway system and is also in the nationally recognized Historic Sites area. Since the bridge is in poor repair the stress caused by lowering or raising the water level significantly may have a serious adverse effect on the bridge structure.

The questions certainly are of a very serious nature and we would like to be able to answer these questions correctly. It seems as though you are the appropriate agency to give us those answers and we would appreciate your assistance.

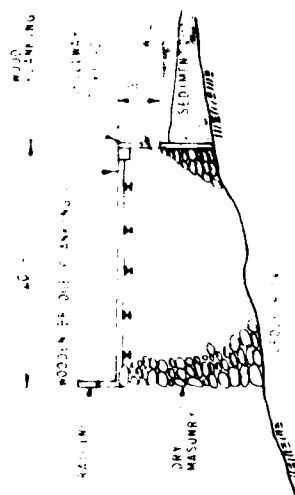
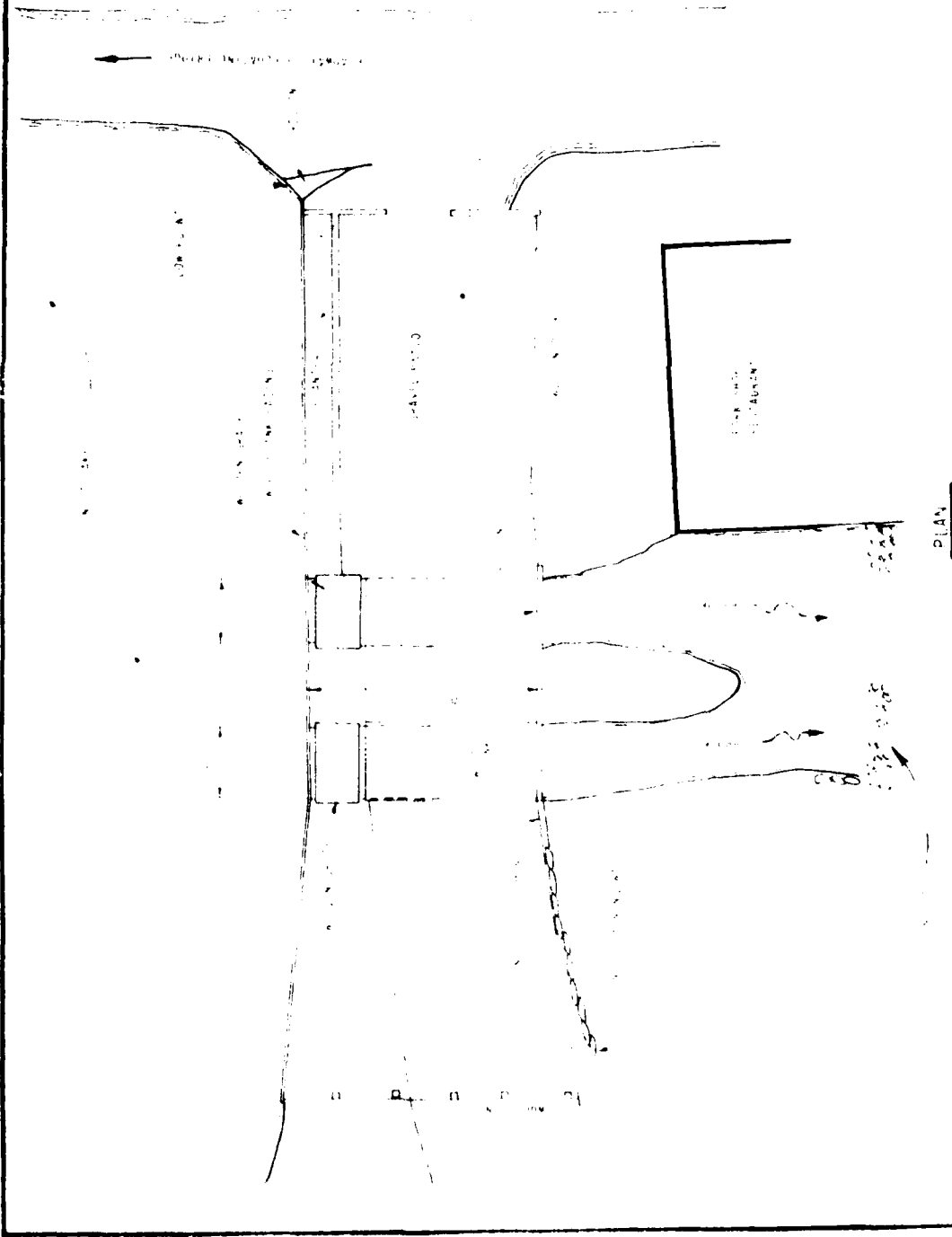
Sincerely,

Thomas E. Lyons, Selectman

276-3366

276-3385

276-3153



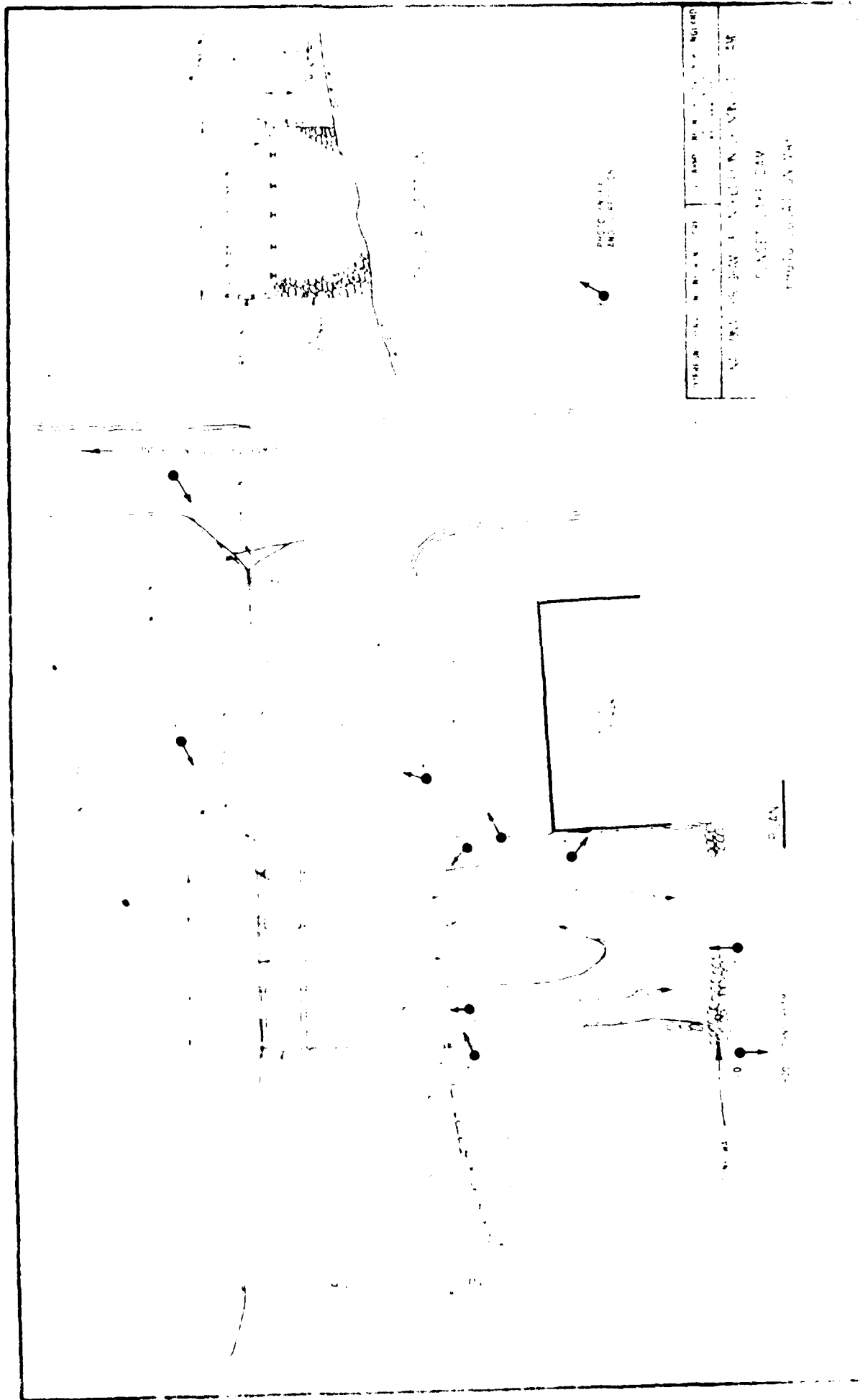
TYPICAL SECTION

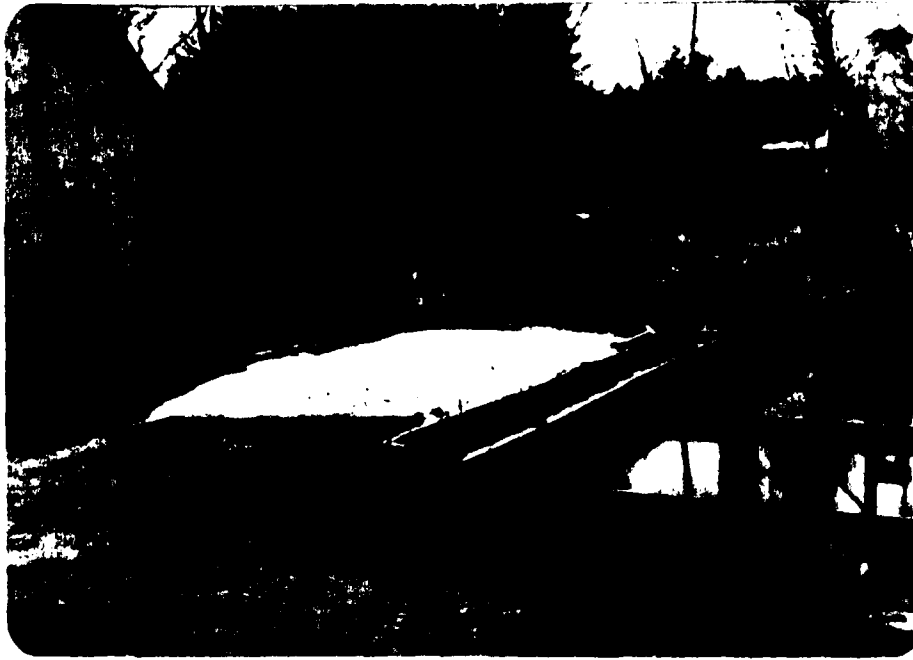
TUPRESSE-HENRY ENGINEERING CORP.
 U.S. ARMY ENGINEER DIV. NEW ENGLAND
 CORPS OF ENGINEERS
 BOSTON, MASS.
 NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
 SUNSET LAKE DAM
 PLAN TYPICAL SECTION

APPENDIX C

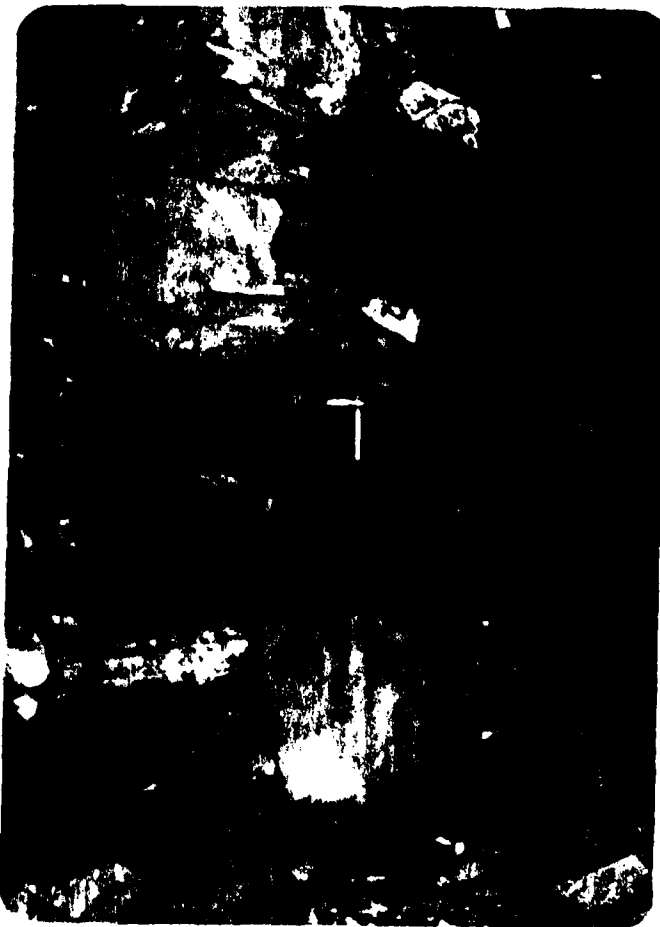
PHOTOGRAPHS

PHOTOGRAPHED BY: [illegible]
 DATE: [illegible]
 TIME: [illegible]
 LOCATION: [illegible]
 SUBJECT: [illegible]
 REFERENCE: [illegible]





#1. TOP OF DAM AND WOOD PLANK FACING.



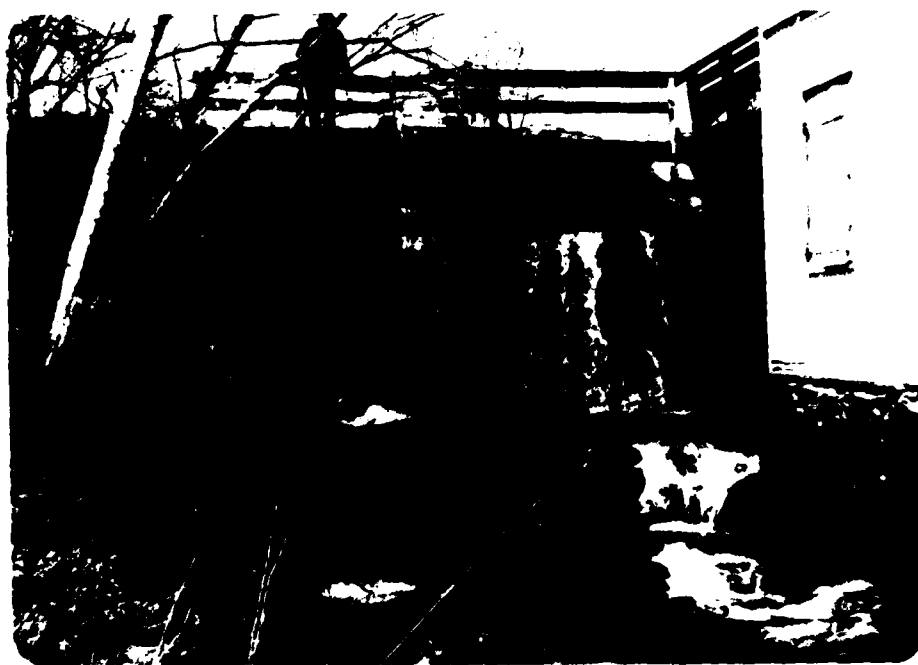
#2. DOWNSTREAM FACE
OF DAM UNDER
RESTAURANT PATIO.



#3. VIEW OF LEAKAGE
AT SPILLWAY.



#4. VIEW OF SPILLWAY INLETS SHOWING WIRE FENCE
AND DEBRIS.



#5. VIEW OF SPILLWAYS AND DOWNSTREAM CHANNEL.



#6. CLOSE-UP VIEW OF RIGHT SPILLWAY.



#7. VIEW OF CRACKED CONCRETE FACING OF RIGHT SPILLWAY.



#8. VIEW OF SUNSET LAKE SHOWING FLOATING BRIDGE.



#9. VIEW OF DOWNSTREAM CHANNEL UNDER RESTAURANT.



#10. VIEW OF DOWNSTREAM FLOOD IMPACT AREA.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

DUFRESNE-HENRY ENGINEERING CORPORATION

W.A.L.
DATE 3-30-79

SUBJECT SUNSET LAKE (BROOKFIELD)
DRAINAGE AREA - CLASSIFICATION

SHEET NO. 1 OF
JOB NO. 04-0299

DRAINAGE AREA

SCALE 1" = 62,500
FINDER .97301 SQ MI / SQ IN

PLANIMETER READING 4.19

$$4.19(.97301) = \underline{\underline{4.08 \text{ SQ MILES}}}$$

POUND AREA

21 ACRES

STORAGE

17,000,000 CU FT

=

390 AC-FT

CLASSIFICATION

SIZE

HEIGHT 17'
STORAGE 390 AC-FT

SMALL

HAZARD

3 HOUSES DOWNSTREAM

SIGNIFICANT

DUFRESNE-HENRY ENGINEERING CORPORATION

BY W.A. LEONARD

SUBJECT SUNSET LAKE (BOCKFELD)

SHEET NO. 2 OF

DATE 6-11-70

TEST FLOOD

JOB NO. 64-0090

TEST FLOOD

FOR SMALL DAM WITH SIGNIFICANT HEAD
TEST FLOOD IS 100 YR \rightarrow $\frac{1}{2}$ P.M.F.

USE 100 YR FLOOD AS TEST FLOOD

100 YEAR FLOOD

DOMINANT SOIL GROUP IS CHLAIS - BUCKLAND ASSOC.

HYDROLOGIC GROUP "C"

USE CURVE #13

SLOPE MODERATE

100 YEAR RAINFALL = 5.3 INCHES

FROM S.C.S. ES-1027 SHEET 11 OF 21

100 YEAR PEAK DISCHARGE FOR 2000 ACRES = 1020

DRAINAGE AREA = $4.08(640) = 2611$ ACRES

PEAK DISCHARGE = $1020 \left(\frac{2611}{2000} \right)^{.75} = \underline{\underline{1246}}$

ROUTING

USING TABLE 2-2 S.C.S.

$$\text{RATIO } \frac{D.A.}{\text{Peak Area}} = \frac{2611}{90} = 29$$

INTERPOLATING GIVES A FACTOR OF .81

$$\Rightarrow .81(1246) = 1009 \text{ CFS}$$

USE 1010 C.F.S. AS TEST FLOOD

DUFRESNE-HENRY ENGINEERING CORPORATION

BY W.A. LEONARD

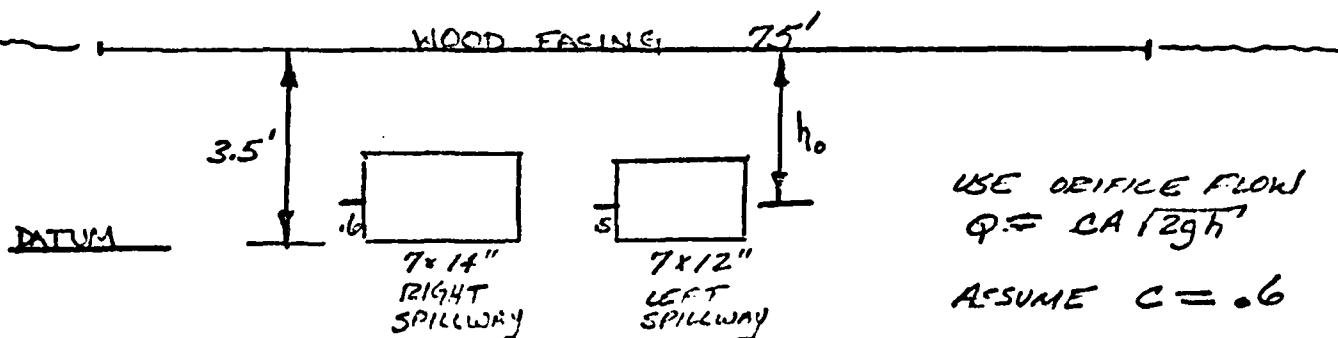
SUBJECT SUNSET LAKE (BROOKFIELD)

SHEET NO. 3 OF

DATE 6-11-79

DISCHARGE CALCULATIONS

JOB NO. CA-0099



USE ORIFICE FLOW
 $Q = CA \sqrt{2gh}$

ASSUME $C = .6$

FOR OVERBANK FLOW USE $Q = CAH^{3/2}$

ASSUME $C = 2.5$

STAGE	(h_o)	AREA RIGHT	h_o	AREA LEFT	Q LEFT	OVERWALK LENGTH			Q TOTAL	
2	1.4	6.17	46.6	1.5	7.0	41.3			87.9	
3	2.4	8.17	60.9	2.5	7.0	53.3			114.2	
3.5	2.9	8.17	67.0	3.0	7.0	58.4			125.4	
4	3.4	8.17	72.5	3.5	7.0	63.1	.5	150	133	263.6
4.5	3.9	8.17	77.7	4.0	7.0	67.4	1.0	170	425	570.1
5	4.4	8.17	82.5	4.5	7.0	71.5	1.5	175	804	958.0
6	5.4	8.17	91.4	5.5	7.0	79.0	2.5	180	1779	1949.4
7	6.4	8.17	99.5	6.5	7.0	85.9	3.5	185	3028	3213.4

STORAGE

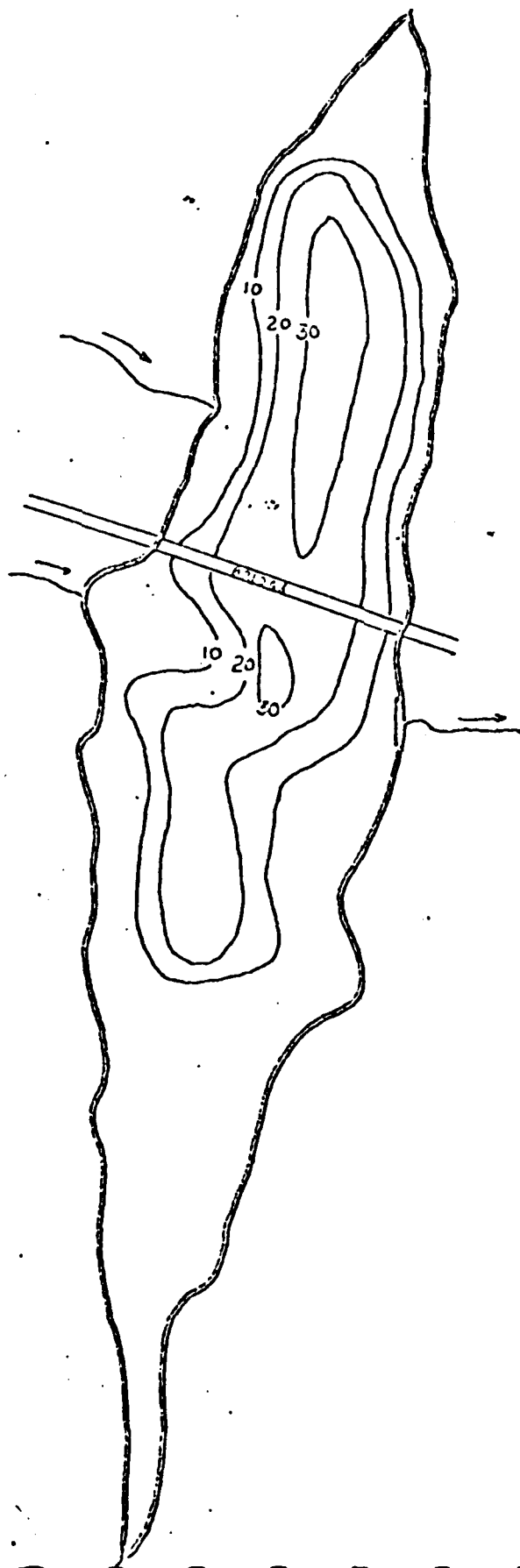
Normal pool estimate (see next page).

DUFRESNE-HENRY ENGINEERING CORPORATION

BY JAD
DATE 6/28/79

SUBJECT SUNSET LAKE
VOLUME

SHEET NO. 4 OF
JOB NO. 04-0099



SURFACE AREA = 21 ACRES
(RECREATIONAL POOL)

VOLUME =

$$0'-10' = 6.39 \times 10^6 \text{ FT}^3$$

$$10'-20' = 3.42 \times 10^6 \text{ FT}^3$$

$$20'-30' = 1.62 \times 10^6 \text{ FT}^3$$

$$\text{TOTAL} \quad \underline{11.43 \times 10^6 \text{ FT}^3}$$

$$= \underline{262} \text{ ACRE FEET}$$

TEST FLOOD POOL (ESTIMATE)

5 FOOT SURCHARGE

$$\text{SAY } 28 \text{ ACRES} \times 5 = 140$$

$$140 + 262 = \underline{402} \text{ ACRE FEET}$$

TOP OF DAM

3.5 FOOT SURCHARGE

$$\text{SAY } 25 \text{ ACRES}$$

$$25 \times 3.5 = 87.5$$

$$87.5 + 262 = \underline{350} \text{ AC. FT}$$

DUFRESNE-HENRY ENGINEERING CORPORATION

BY W.A. LEWIS
DATE 6-12-79

SUBJECT SUNSET LAKE (BROOKFIELD)
DAM FAILURE ANALYSIS

SHEET NO. 5 OF
JOB NO. 01-2099

DAM FAILURE WITH WSEL @ TOP OF DAM ($y_0 = 12.4'$)

ASSUME DAM WIDTH SUSCEPTIBLE TO FAILURE IS THAT SECTION BETWEEN LEDGE OUTCROPPING ON RIGHT ABUTMENT AND NATURAL GROUND ON THE LEFT ABUTMENT.

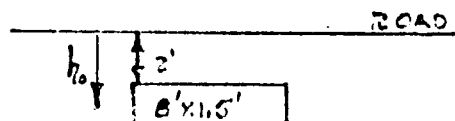
ASSUME SUSCEPTIBLE WIDTH = 90 FEET

$$Q_{FAILURE} = \frac{8}{27} W_b \sqrt{g} y_0^{3/2}$$

$$Q_F = \frac{8}{27} (.4)(90) \sqrt{32.2} (12.4)^{3/2} = \underline{\underline{2693 \text{ CFS}}}$$

$$\text{INITIAL WAVE} = 12.4^{(2/3)} = \underline{\underline{8.3 \text{ FEET HIGH}}}$$

WAVE WOULD BE CONTAINED IN CHANNEL UNTIL IT REACHED THE FIRST HOLE DOWNSTREAM OF DAM. HERE THE STREET MAKES A RIGHT ANGLE TURN AND ENTERS A 8'x1.5' STONE BOX CULVERT



ASSUME WATER 2' OVER ROAD
ORIFICE FLOW FOR BOX CULVERT

$$h_0 = 5.15' \quad Q = CA \sqrt{2g h_0^3} = .6(8)(1.5) \sqrt{64.4(5.15)} = 129$$

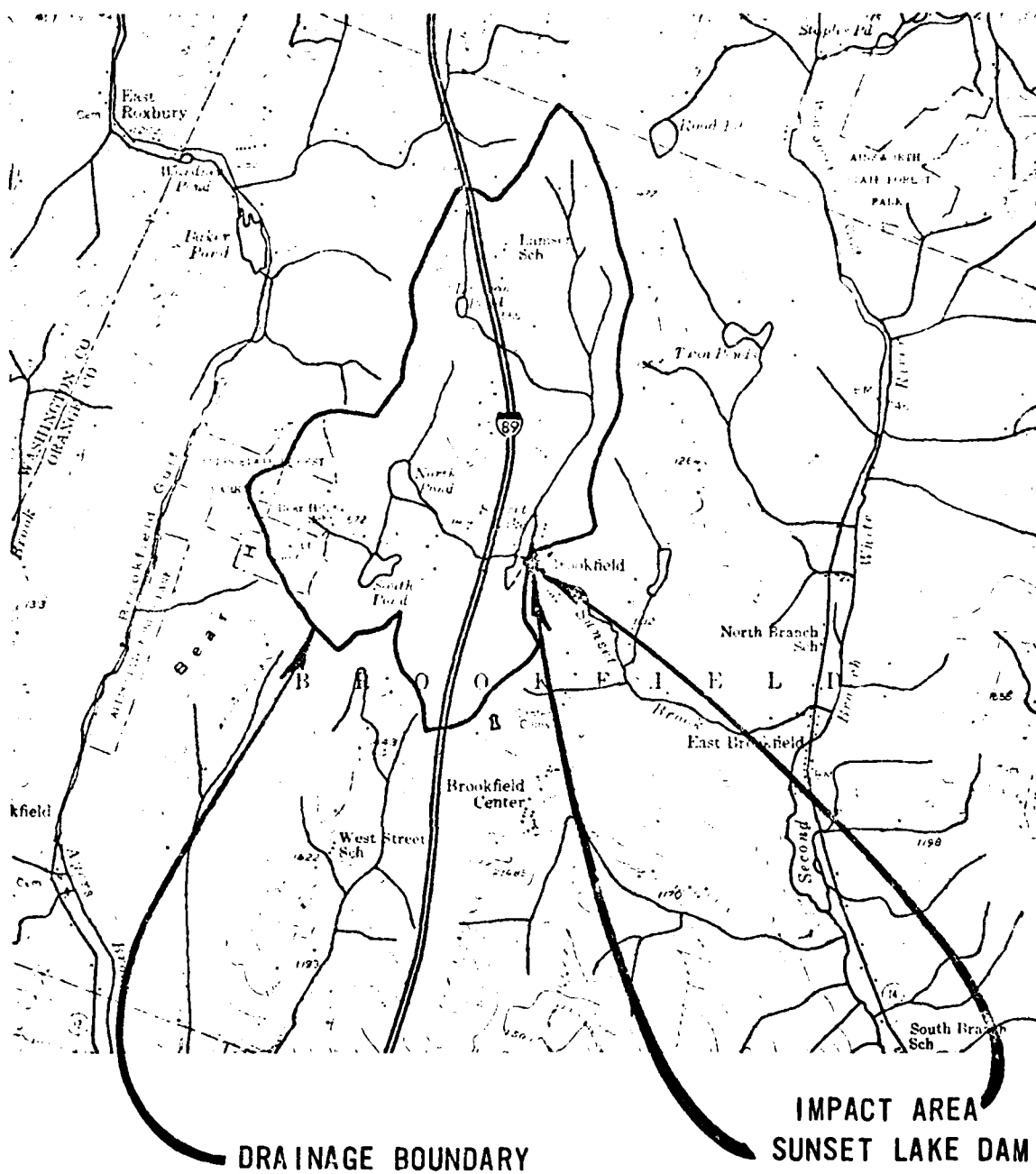
WEIR FLOW OVER ROAD

ASSUME 150 FEET WEIR LENGTH

$$h_w = 3.0' \quad Q = C A H^{3/2} = 2.5(150)(3)(3)^{3/2} = 1749$$

$$Q_{TOTAL} = 2093$$

" WAVE WOULD BE APPROXIMATELY 3' OVER ROAD.



SOURCE OF MAP:
U.S. GEOLOGICAL SURVEY
BARRE QUADRANGLE
VERMONT
15 MIN. SERIES
1957

DUFRESNE-HENRY ENGINEERING CORP.
ARCHITECT-ENGINEER

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION MAP
SUNSET LAKE DAM

CLIENT NO. 04-0099
ENGR. JAD

SCALE 1"=1 MILE
DATE

APPENDIX E

Information as Contained in the National Inventory of Dams

STATE	VT	IDENTITY NUMBER	201	DATE	01/17/01	CONTRACT NUMBER	017	NAME	SUNSET LAKE DAM	REPORT DATE	06 JUN 79
-------	----	-----------------	-----	------	----------	-----------------	-----	------	-----------------	-------------	-----------

POPULAR NAME	SUNSET LAKE	NAME OF IMPOUNDMENT	SUNSET LAKE-COLTS POND
REGION/DASH	01 00	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE
TYPE OF DAM	1900 R	PURPOSES	BRUOKFIELD VERMONT

TYPE OF DAM	1900 R	YEAR COMPLETED	12	12	180	100	50
REPUT	12	12	12	12	12	12	12

REMARKS	21-DAY STONE MASONRY 22-APPROX.
REMARKS	

OWNER	GREEN TRAILS RESORTS INC	ENGINEERING BY	CONSTRUCTION BY
-------	--------------------------	----------------	-----------------

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
VT WATER RESOURCES	VT WATER RESOURCES	VT WATER RESOURCES	VT WATER RESOURCES
INSPECTION BY	INSPECTION DATE	INSPECTION DATE	INSPECTION DATE
DUPHESNE HENRY	24 APR 79	24 APR 79	24 APR 79

REMARKS	12-2 SPILLWAYS 7 FL EA 33-TOTAL
---------	---------------------------------

END

FILMED

9-85

DTIC